



Learning To See

VSM

(Value-Stream Mapping)



**Whenever there is a product for a customer, there is a value stream.
The challenge lies in seeing it.**



VALUE STREAM MAPPING = MATERIAL & INFO FLOW MAPPING

1. Adding value
2. Eliminating
Waste
3. Establishing
flow



What is VSM ?

- All the actions (both value added & non-value added) currently required to bring a product through the main flows essential to every product.

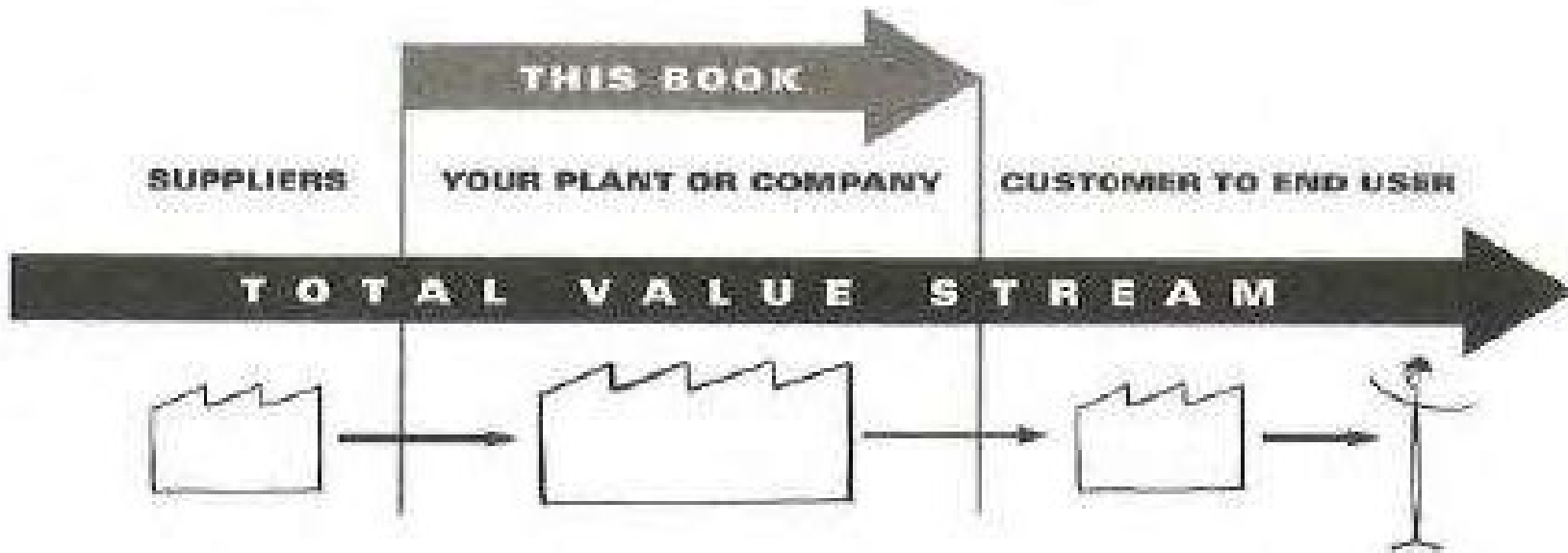
Types:

1. Production: Raw Material to the customer
2. Design: Design to concept launch



What is VSM ?

- What we are going to study here is “Door-to-Door”





Why VSM is an essential tool ?

1. It helps you visualize more than just the single-process level. (i.e. assembly, welding ...etc.)
2. Mapping helps you to see more than waste and its sources.
3. It makes decisions about the flow apparent, so you can discuss them.
4. It ties together lean concepts and techniques which helps you avoid “cherry picking”*
5. It forms the basis of an implementation plan. VSM becomes blueprint for lean manufacturing.
6. It shows the linkage between the information flow and the material flow.
7. VSM is a qualitative tool by which you describe in detail how your facility should operate in order to create flow. Numbers are good for creating sense of urgency or as before/after measures. VSM is good for describing what are actually going to do to affect those numbers



- **Material and information flows**



To create Value-adding flow you need a vision. Mapping helps you see and focus on flow with a vision of an ideal or improved state.



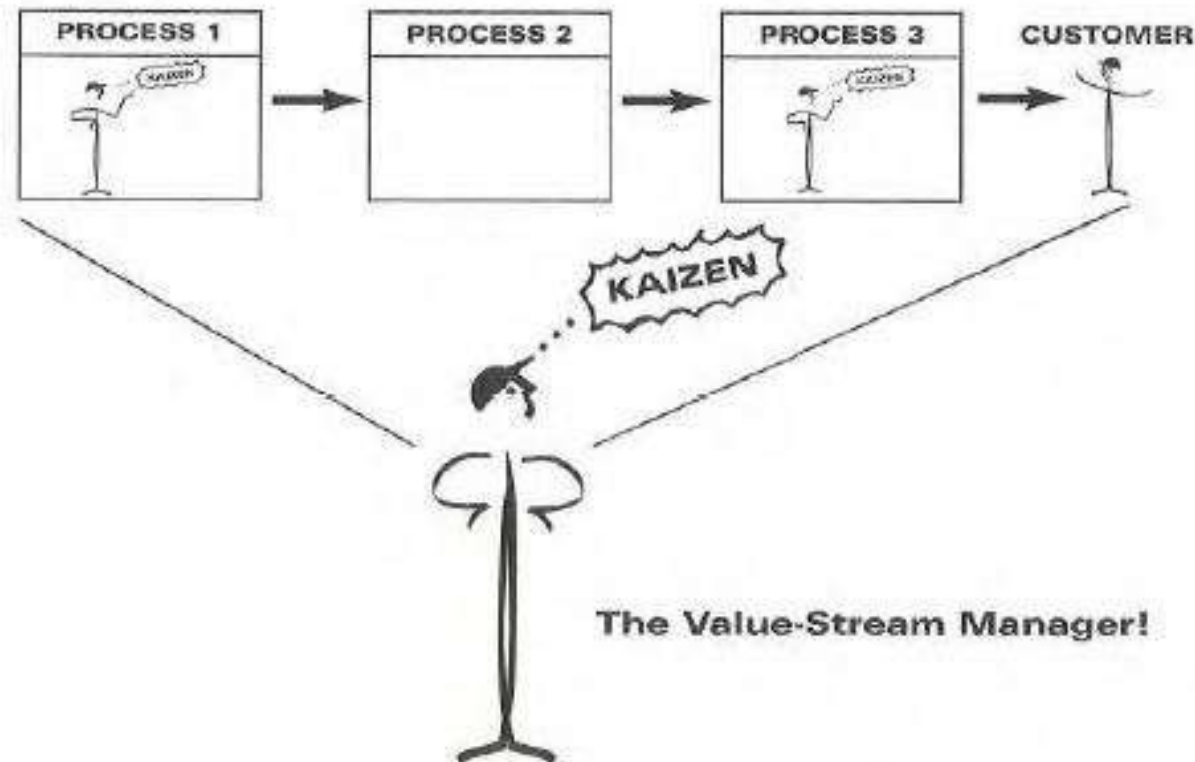
- **Selecting a Product Family**
- Family: group of products that pass through similar processing steps and over common equipment in the downstream process.

		Assembly Steps & Equipment							
		1	2	3	4	5	6	7	8
PRODUCTS	A	X	X	X		X	X		
	B	X	X	X	X	X	X		
	C	X	X	X		X	X	X	
	D		X	X	X			X	X
	E		X	X	X			X	X
	F	X		X		X	X	X	
	G	X		X		X	X	X	

A Product Family



- **Value Stream Manager**



Toget away from the “Isolated Islands” of Functionality

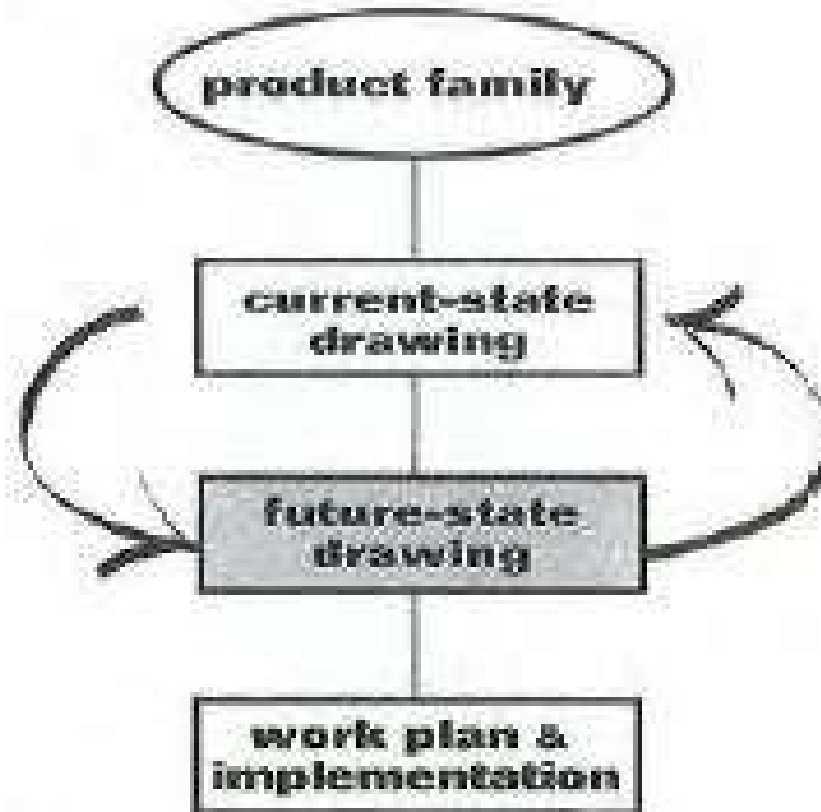


- **Kaizen**
- **Flow Kaizen** : Value Stream improvement, it focuses on material and info.
- **Process-Level Kaizen** : Elimination of waste at the shop floor , it focuses on people and process flow.

One improves the other.



Initial VSM steps





The Current-State Map

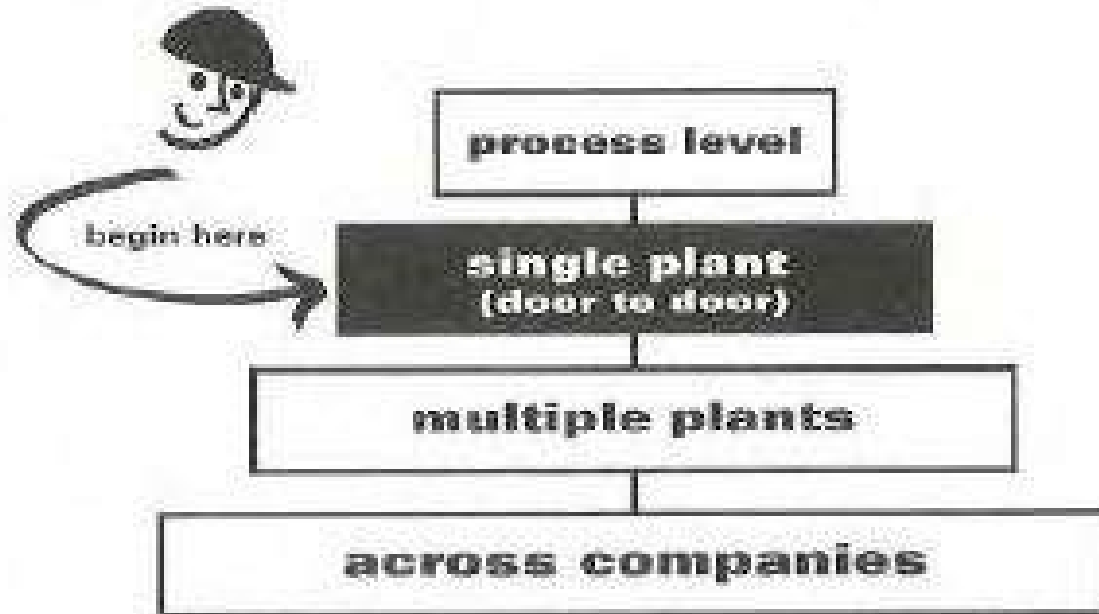


Current-State Map

- **Purpose:** make clear the current production situation by drawing the material & info flows.



Current-State Map



Mapping begins at the level of the door-to-door flow in the plant



• Mapping tips

- Always collect current-state info while walking along the actual pathways of material and info flows yourself.
- Begin with quick walks along the entire door-to-door value stream.
- Begin at the shipping end and work upstream, instead of starting at the receiving dock and walking downstream.
- Bring your stopwatch and do not rely on standard times or info that you do not personally obtain.
- Map the whole value stream **YOURSELF**.
- Always draw by hand and pencil.

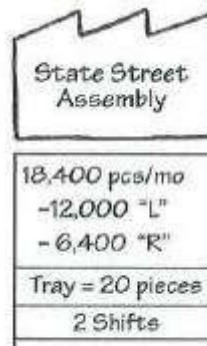


The idea of value stream mapping is not map, But understanding the flow of info and material.

• Drawing the Current-State map

The mapping begins with the customer requirements.
(Lean Thinking)

1. Factory Icon: mapping starts with the customer's requirement represented by the **factory icon** placed on the right side. **Data box** under it recording the requirements.

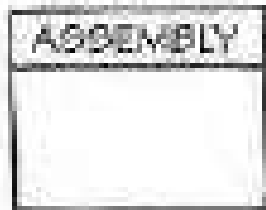


- **Drawing the Current-State map**

2. Drawing the basic production process.

Process Box: indicates a process in which the material is flowing.

- Material flow is drawn from left to the right.





• Drawing the Current-State map

- List of typical process description:
 1. C/T (cycle time)
 2. C/O (Change over time)
 3. Uptime
 4. EPEX (Every part every_) : production batch size
 5. Number of operators
 6. Number of product variations
 7. Patch size
 8. Scrap rate
 9. Working time

- **Drawing the Current-State map**

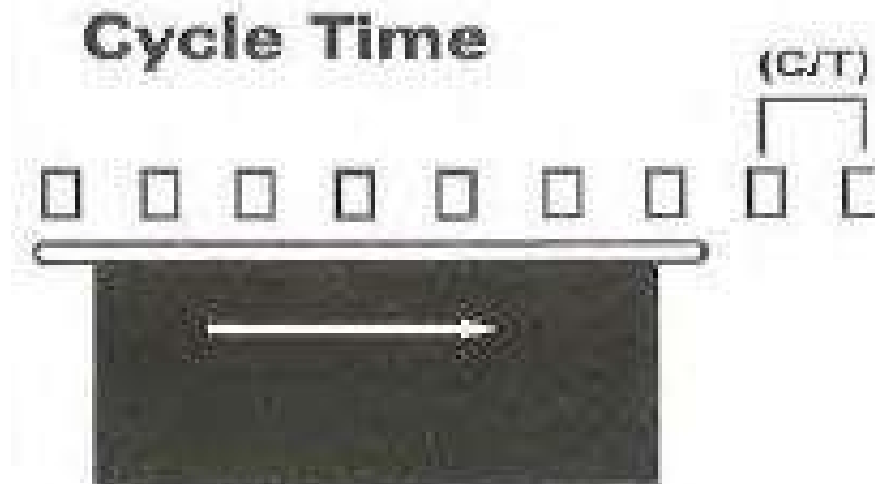
- ***Inventory accumulates*** capture the location and amount of inventory.



- **Drawing the Current-State map**

- Some Lean Measurements:

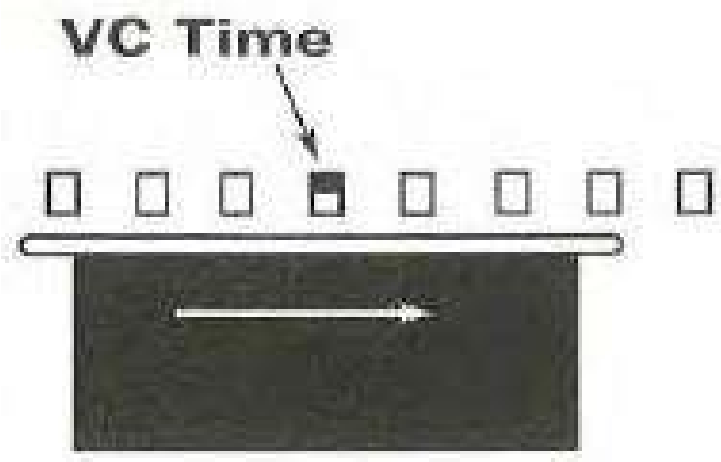
1. **C/T**: the time it takes an operator to go through all of their work elements before repeating them.





- **Drawing the Current-State map**

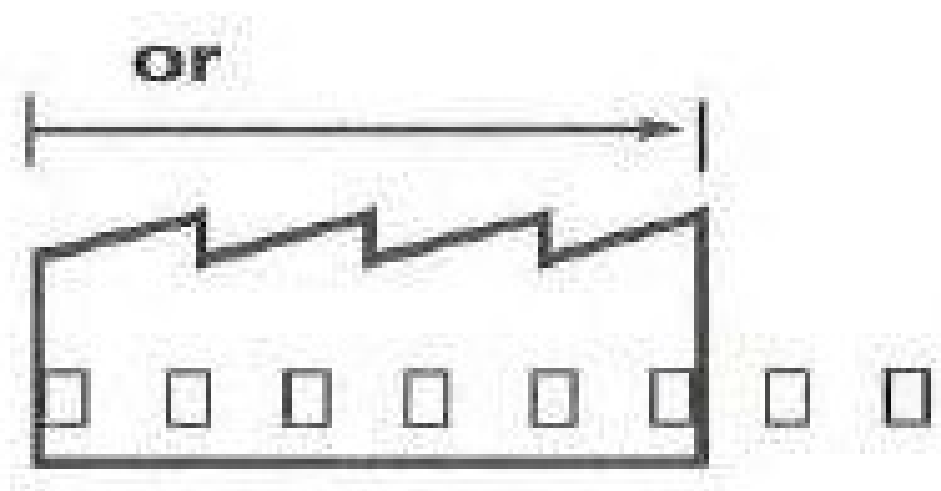
2. **VCT (Value Creating Time):** time of those work elements that actually transform the product in a way that the customer is willing to pay for.





- **Drawing the Current-State map**

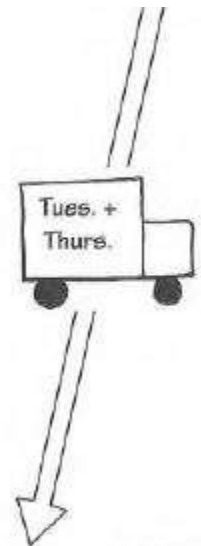
3. **L/T (Lead Time):** time from start to finish through the process or value stream.



- **Drawing the Current-State map**

3. *Truck icon* & a Broad Arrow:* indicate the movement to finished goods to the customer.

- Do not map every purchased part in your family. Just draw for one or two main raw materials.



- **Drawing the Current-State map**

4. **Information Flow**: describing different information flows arrows.





- **Drawing the Current-State map**

5. Production Control Department

- Drawn with a ***Process Box.***
- MRP : Material Requirements Planning system (computerized)
- Go See : Manual Scheduling

60

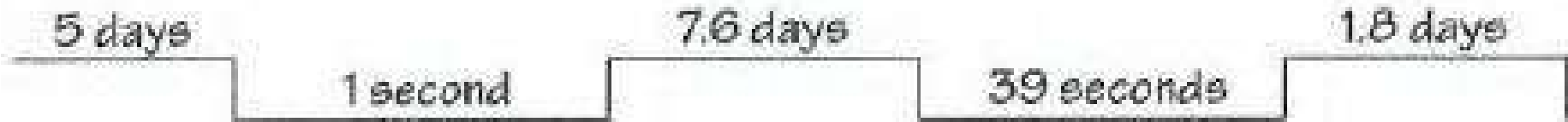
- **Drawing the Current-State map**

6. ***Push***



7. ***Time line:*** under the process box.

- The shorter the production lead time, the shorter the time between paying for raw material and getting payed for product made from these materials.





- **Drawing the Current-State map**
- Lead time (in days): for each inventory triangle are calculated.

$$\text{Inventory Quantity} = \frac{\text{-----}}{\text{Daily Customer requirement}}$$



**What makes a VS
lean ?**



What makes a VS lean ?

- Over Production:

Mass Production = Batch & Push

(Operates as an Isolated Island)

It is producing more, sooner or faster than is required by the next process.

It the most significant source of waste.



What makes a VS lean ?

Over Production

- **Mass Production Thinking**

The more and faster you produce, the cheaper is to produce.

Note: True only for a Direct- cost-per-item perspective.

- **Lean Manufacturing Thinking**

Get one process to make only what the next process needs when it needs it. To generate :

1. Shortest Lead time
2. Highest Quality
3. Lowest Cost



What makes a VS lean ?

- Characteristics of lean VS guidelines:

1. Produce to **Takt time**:

- Takt time: Synchronizes pace of production to match pace of sales.

$$\text{day } T = \frac{\text{Available working time per}}{\text{Customer demand rate per day}}$$



What makes a VS lean ?

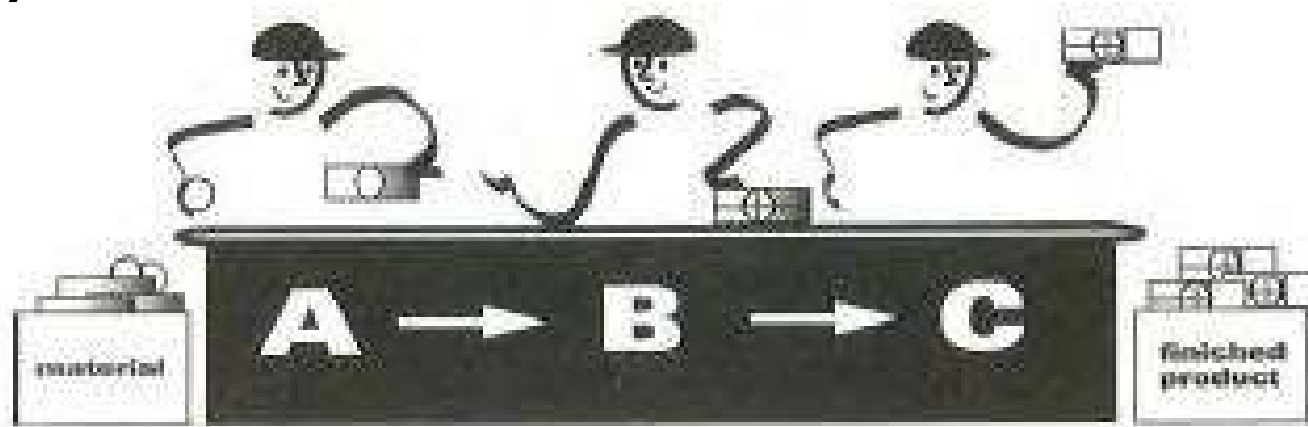
Characteristics of lean VS guidelines

- Takt time:
 - It is a reference no. that give you sense for the rate at which a process should be producing.
 - Producing to takt time sounds simple, BUT it requires concentrated effort to :
 - Provide fast response (within takt time).
 - Eliminate causes of unplanned downtime.
 - Eliminate changeover time in downstream.



What makes a VS lean ?

2. **Continuous Flow:** producing one piece at a time

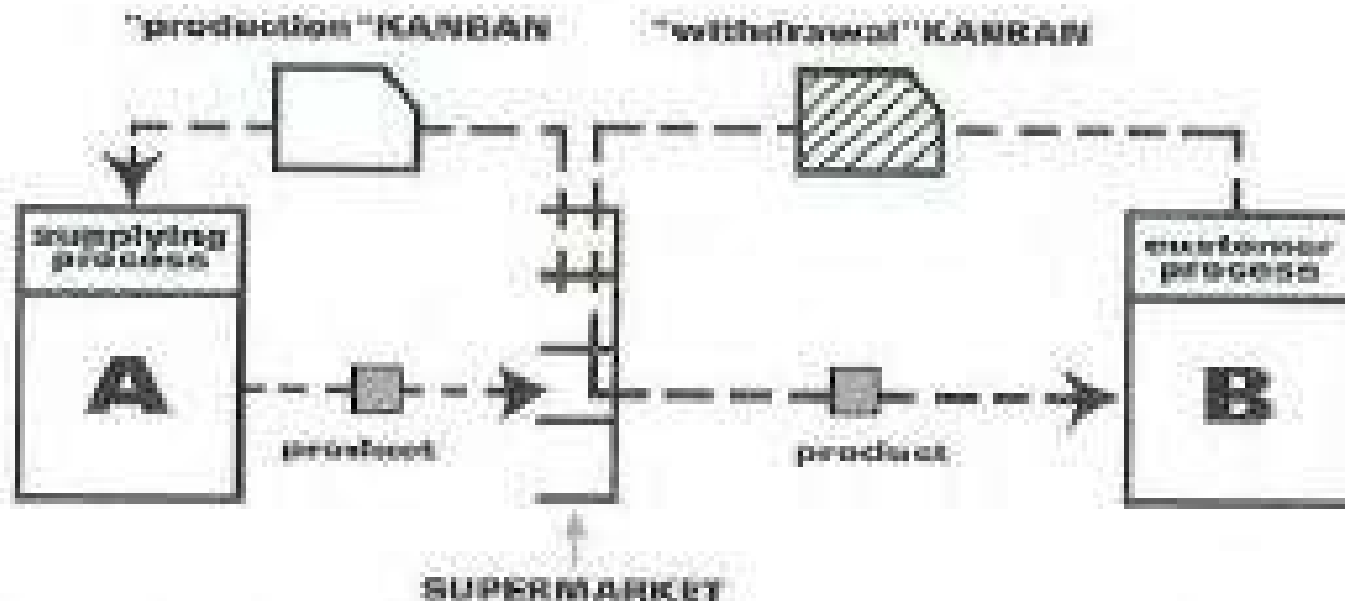


A good approach can be to begin with a combination of continuous flow and some pull/FIFO.



What makes a VS lean ?

3. Supermarket pull system (KANBAN):



Customer Process : goes to supermarket and withdraws what it needs when it needs it
Supplying process : Produces to replenish what was withdrawn

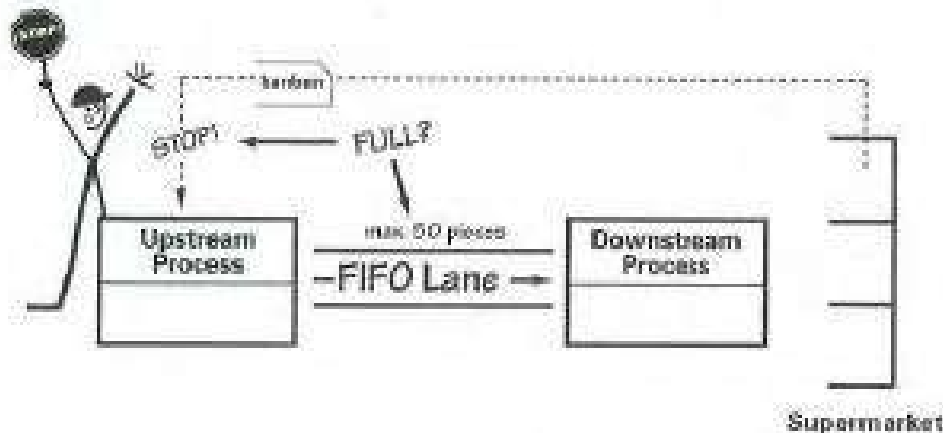
What makes a VS lean ?



Supermarket pull system (KANBAN)

- Pull: is a method of controlling production between flows.
- FIFO Lane (First In First Out): used when it is not practical to keep an inventory of all possible part variations in pull-system supermarket, Example:

- Parts that has short shelf-life.
- Costly parts that are used frequently.



What makes a VS lean ?



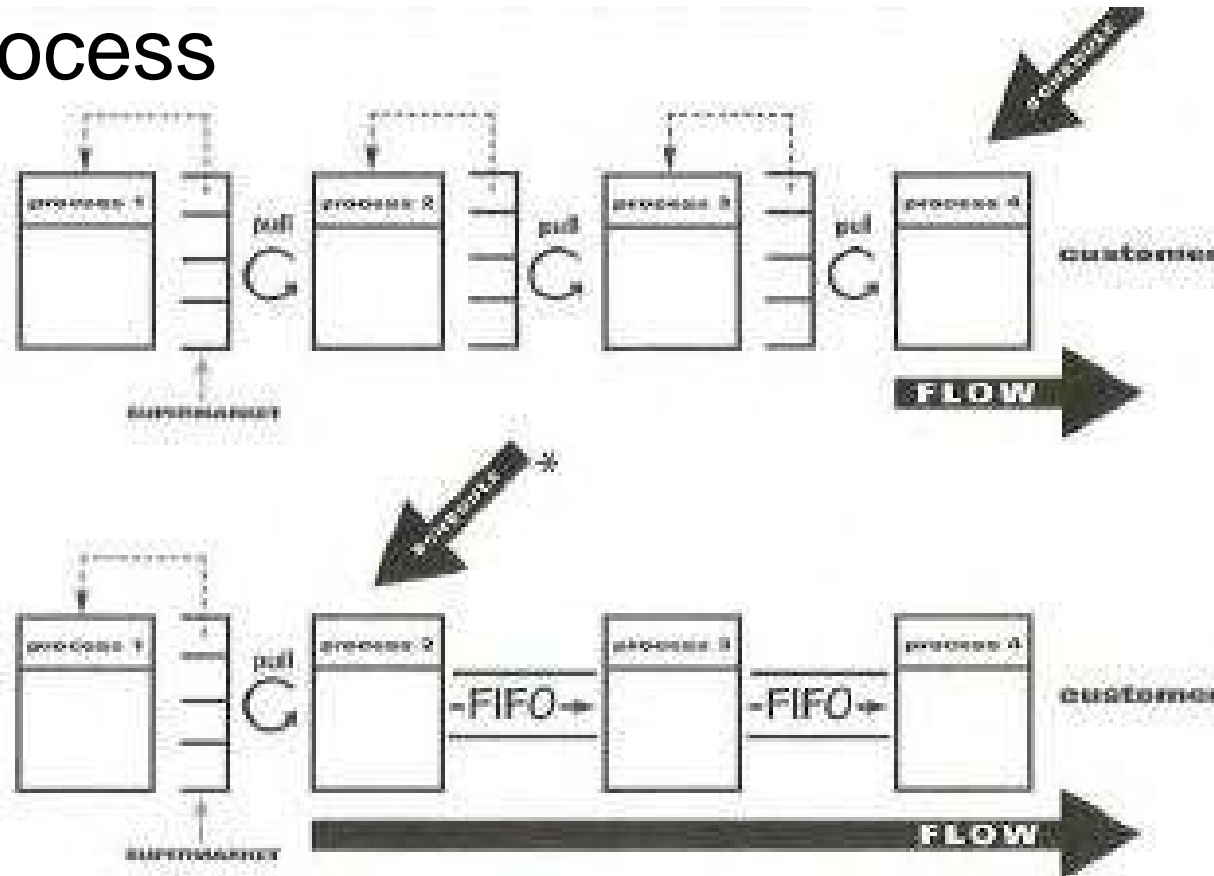
Supermarket pull system (KANBAN)

- “Sequenced Pull” or “The Golf ball system” :



What makes a VS lean ?

4. **Pacemaker:** Try to send the customer schedule to only one production process





What makes a VS lean ?

5. Level the production mix

Distributing the production of different products evenly over a time period.

- Instead of Type “A” in the morning and type “B” in the afternoon, Alternating repeatedly between smaller batches of “A & B”



What makes a VS lean ?

6. Level the Production Volume “Initial Pull”:

- Large batches of work to the shop floor process cause several problems:
 1. No sense of takt time
 2. The situation becomes difficult to monitor “Are we behind or ahead?”
 3. Responding to customer requirements becomes very complicated.
- Level Production volume creates:
 1. A predictable production flow.
 2. Enables to take quick corrective actions.

What makes a VS lean ?



Level the Production Volume “Initial Pull”

- Paced Withdrawal: A good place to start production instruction at the pacemaker process.
- Pitch: It is the consistent increment of work.

Pitch = The no. of parts one finished goods container holds

X

Takt time

What makes a VS lean ?



Level the Production Volume “Initial Pull”

- Example of Pitch :
 - Takt time = 30 seconds
 - Pack Size = 20 pieces

$$\text{Pitch} = 30 \text{ sec} * 20 \text{ pcs} = 10$$

minutes Which means every 10 mins:

- Give the pacemaker process info to produce one pack quantity.
- Take away one finished pitch quantity.

What makes a VS lean ?



Level the Production Volume “Initial Pull”

- How often do you know your performance to customer demand ? “**Management time frame**”

Release work to the floor

One week

It is impossible to produce to takt time situation.

Every Pitch

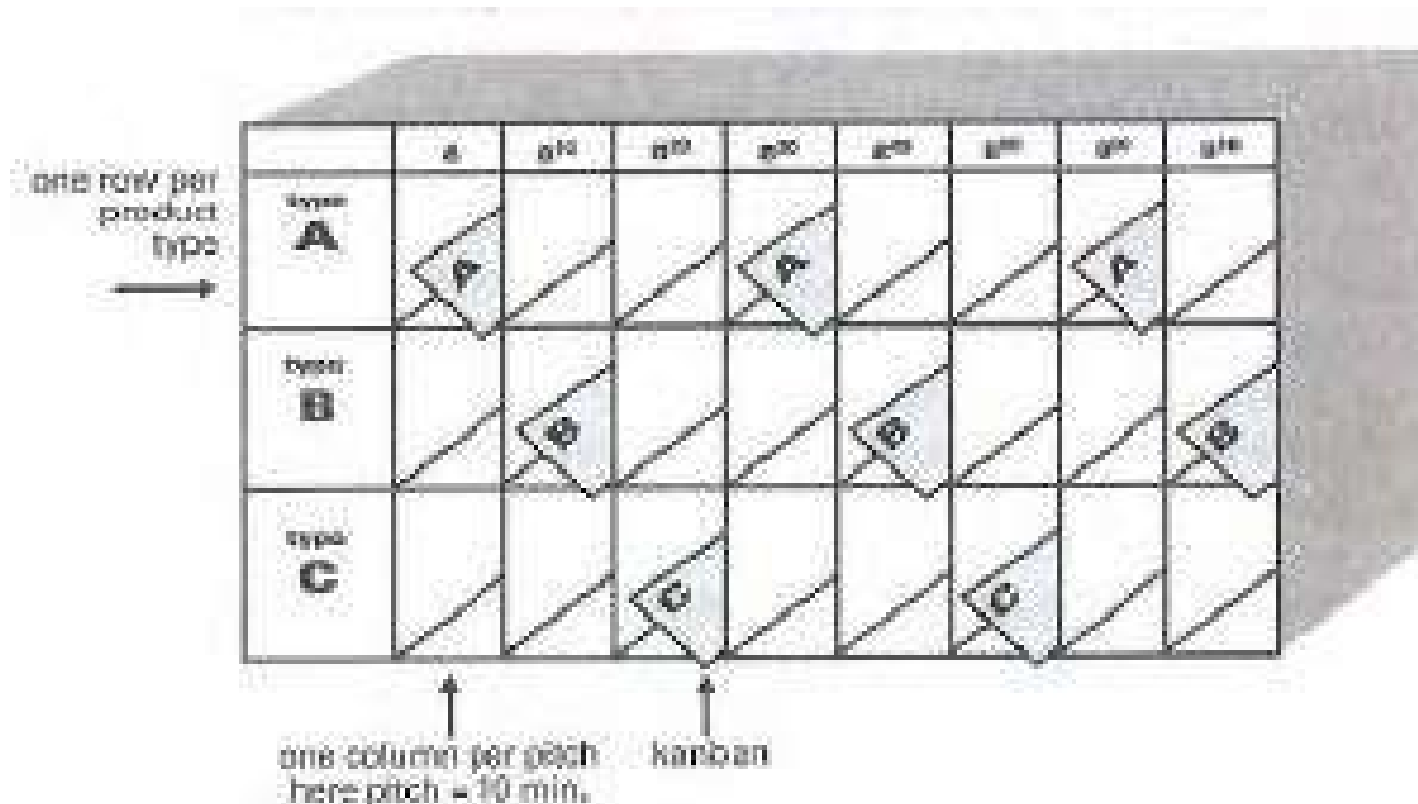
You can rapidly respond to problems and maintain takt time.

What makes a VS lean ?



Level the Production Volume “Initial Pull”

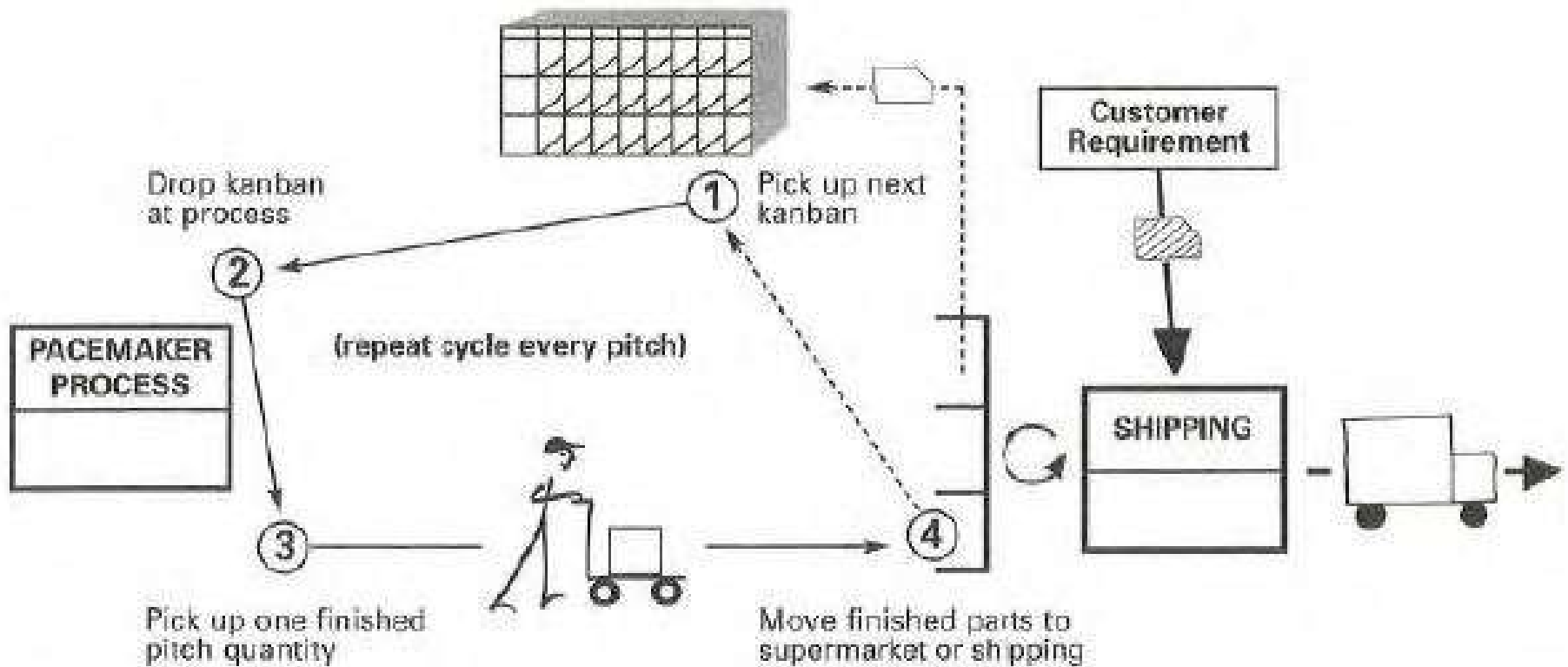
- Load-Leveling box



What makes a VS lean ?



Level the Production Volume “Initial Pull”





What makes a VS lean ?

7. EPEX (Every part every):

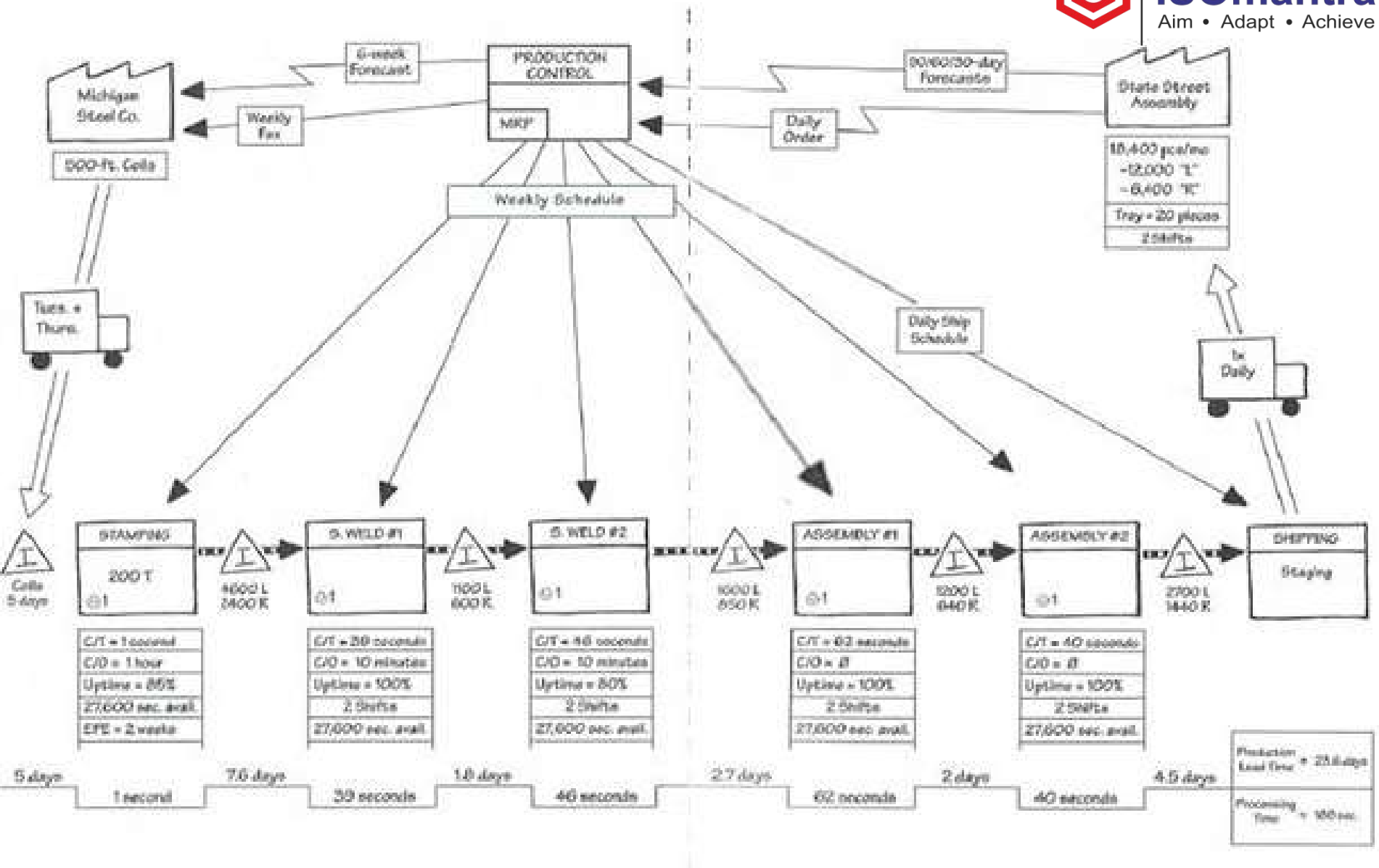
Shortening change over times

&

Running smaller batches in your
fabricatio

n process.

- EPEX (x: day, shift, pitch .. Etc.): This describes how frequently a process changeovers to produce all part variations.





Future State Map



Future State Map

- **Key Questions:**

1. What is the **Takt time** ?
2. Will you build a finished goods **Supermarket** from which the customer will **Pulls**, or directly to shipping ?
3. Where can you use a **Continuous Flow Processing (One Piece Flow)** ?
4. Where will you need to use **Supermarket Pull System (Kanban)** ?



Future State Map

Key Questions

5. At What Single point is in the production Chain (**The Pacemaker Process**) will you schedule production ?
6. How will you **Level the Production Mix** at the pacemaker process ?
7. What increment of work will you consistently release (**Pitch**) and take away to produce ?
8. What Process improvement will be necessary for the value stream to flow as your Future-State design specifies ?

Future State Map

1-Takt time

Available Working time

$$\text{Takt Time} = \frac{\text{Available Working time}}{\text{Customer Demand}}$$

Customer Demand

- A gap between **Takt time** & **Cycle time** indicates the existence of production problems that cause unplanned downtime.

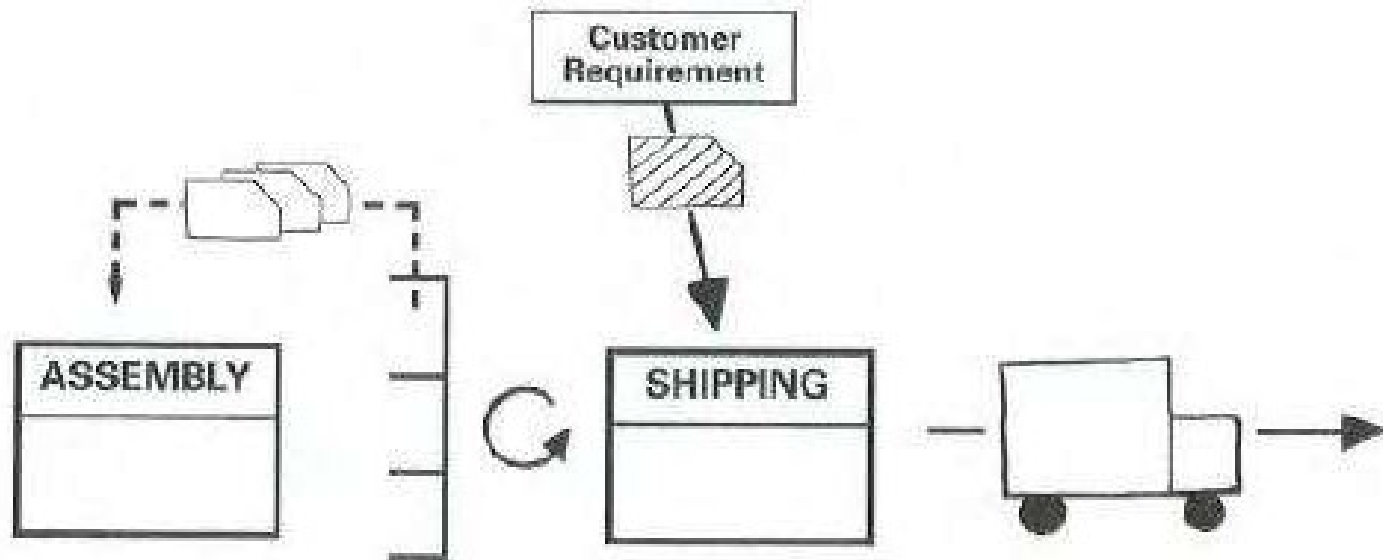


Future State Map

2-Supermarket

Building to a supermarket

(The supermarket schedules assembly)

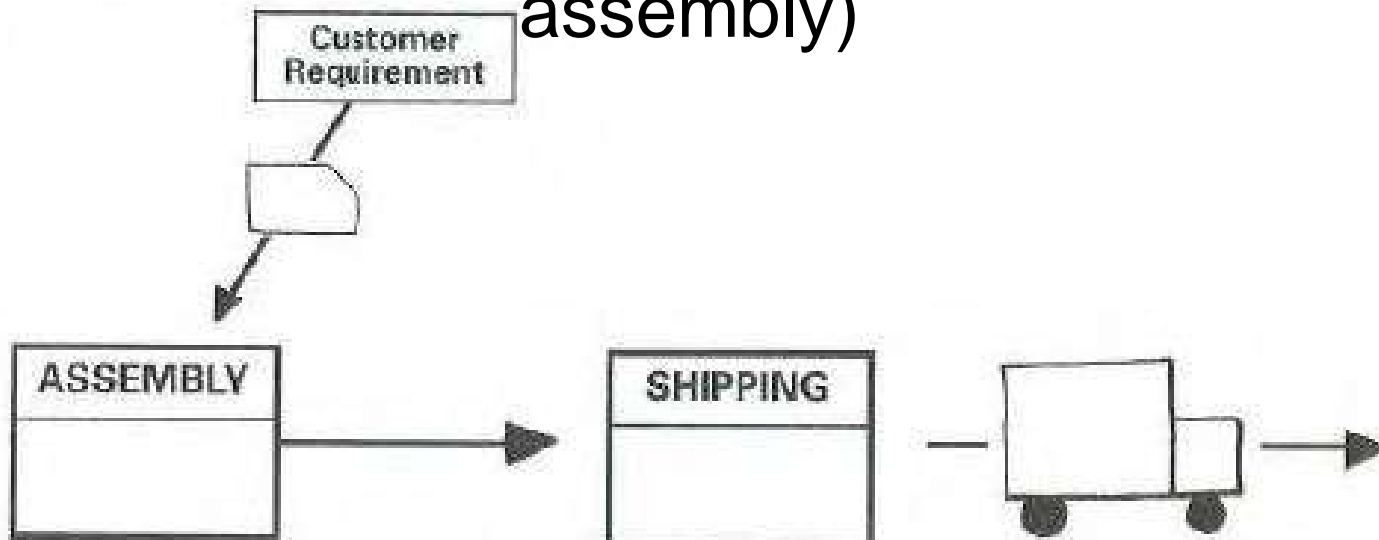




Future State Map

2-Supermarket

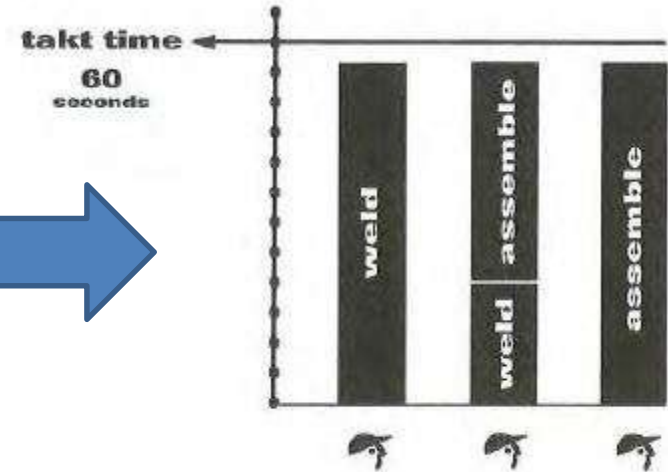
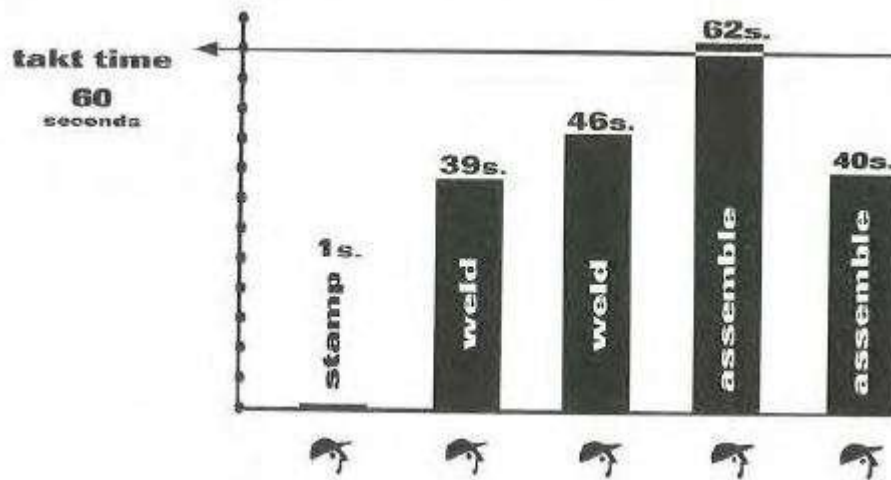
Or Building directly to **Shipping**
(Production Control schedules assembly)





Future State Map

3- Continuous Flow (One Piece flow)



(operator balanced chart)

Total Takt time

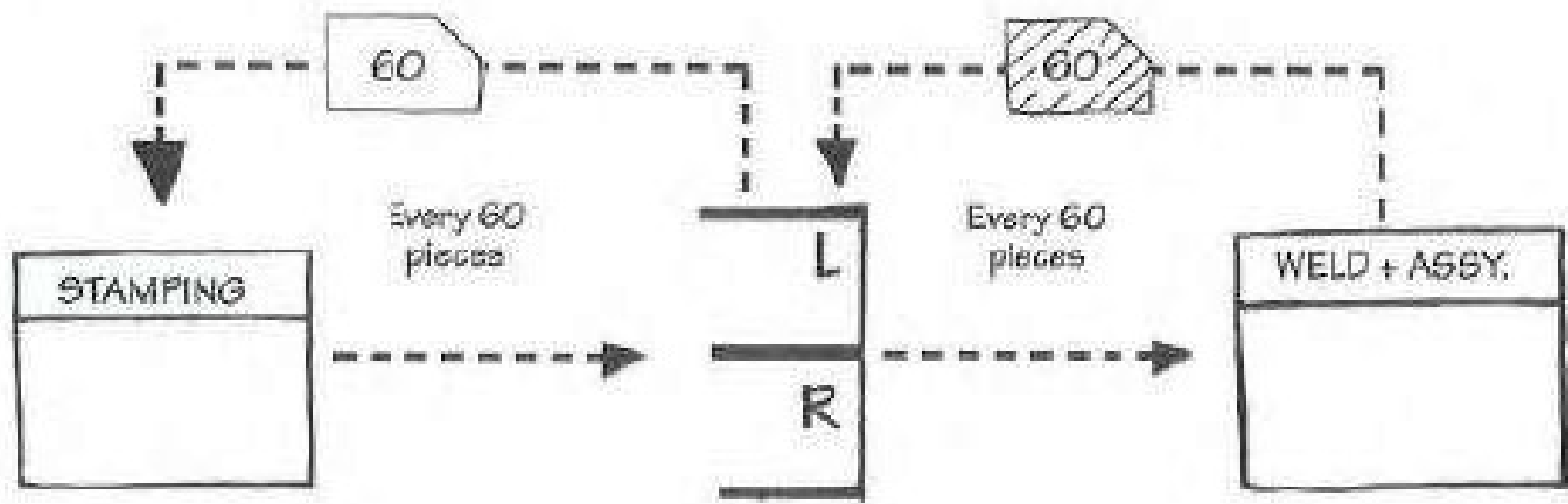
$$\text{Number of operators} = \frac{\text{Total Takt time}}{\text{Number of operators}}$$

Number of operators



Future State Map

4- Supermarket Pull system

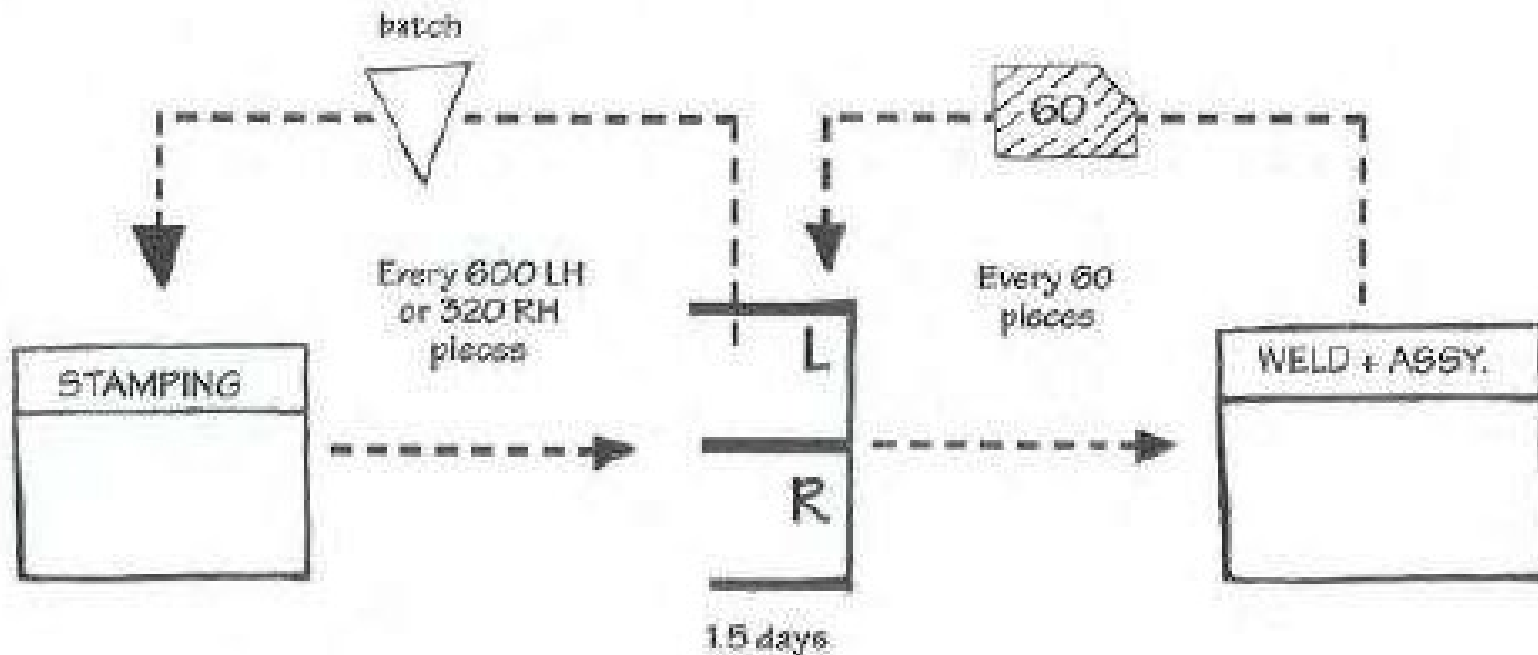


Normal Pull System



Future State Map

4- Supermarket Pull system

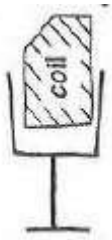


Signal Kanban : The Kanban is brought from the supermarket whenever the number of bins remaining in the supermarket drops to a minimum point



Future State Map

4- Supermarket Pull system



Kanban Post:

- » Internal withdrawal kanban between **Production Process & Production Control Department.**
- » **Production Control** then can order form the **Supplier** based on actual usage instead of **MRP's** forecast.



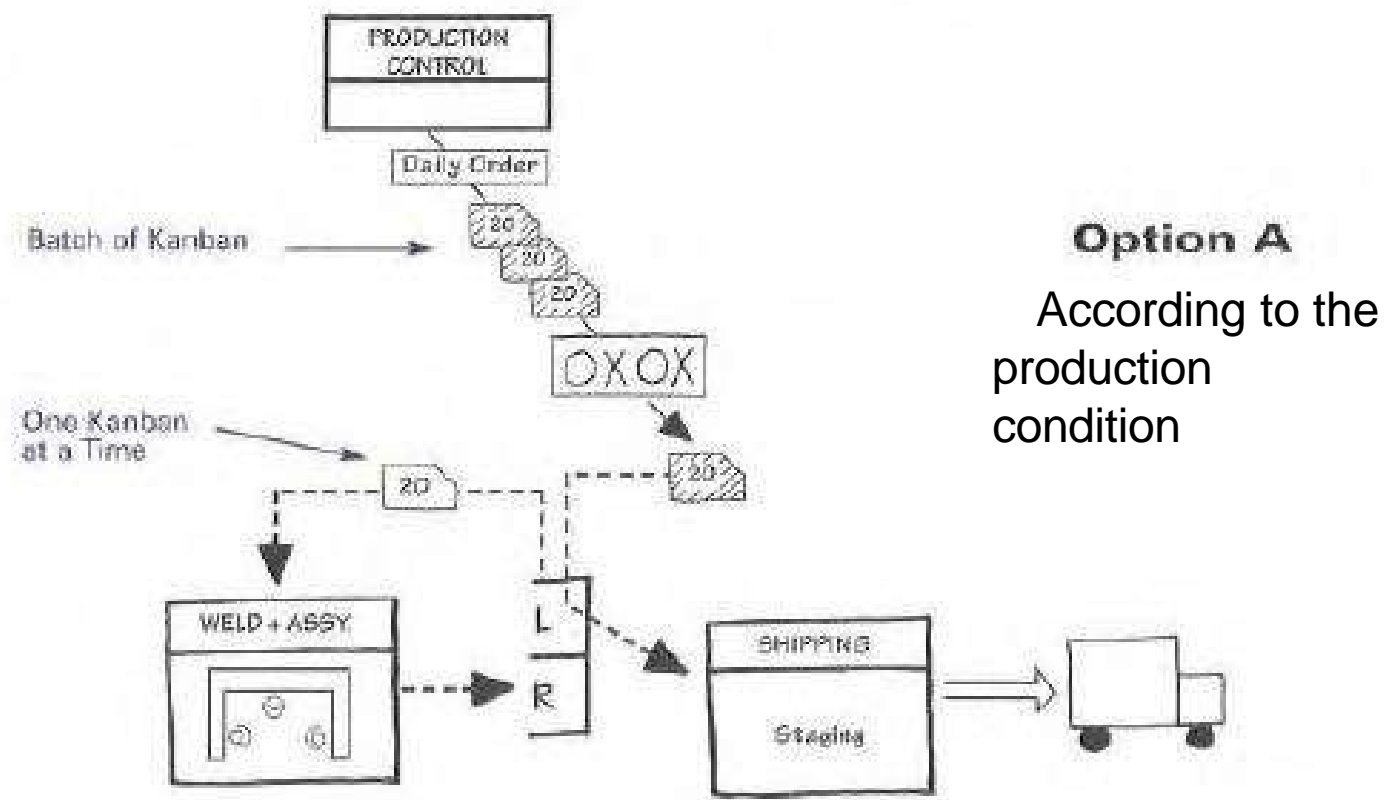
Future State Map

5- The Pacemaker Process



Future State Map

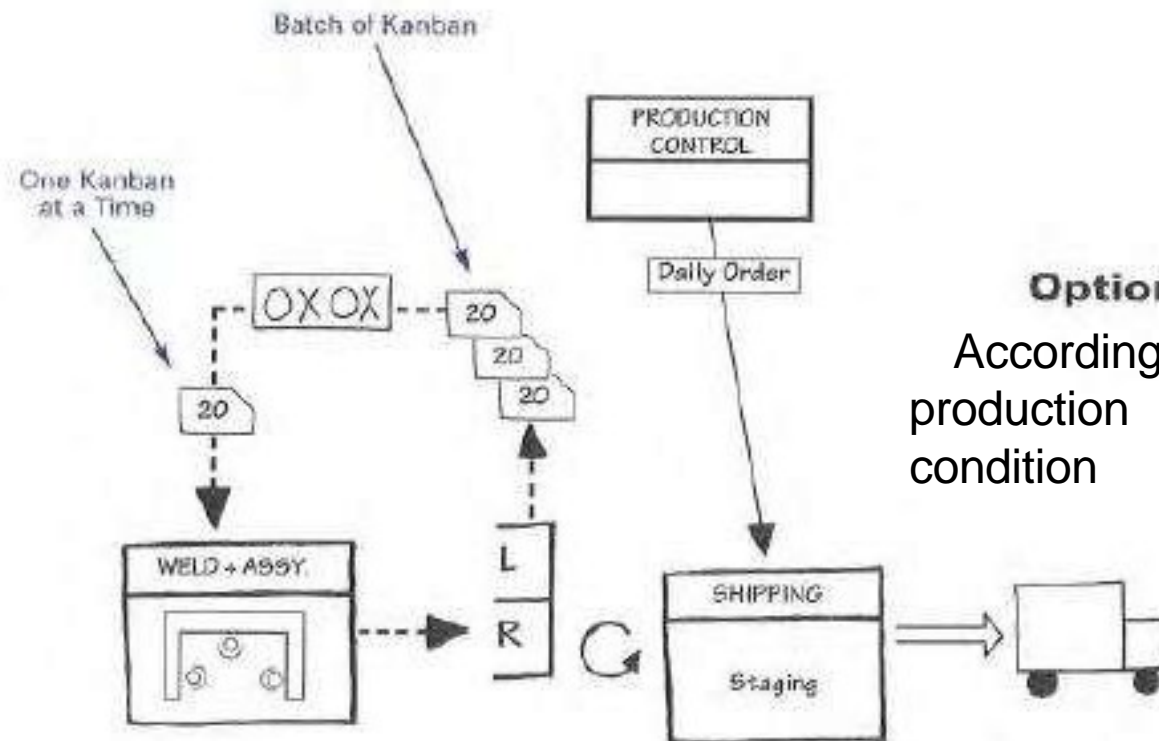
6- Leveling the Production Mix





Future State Map

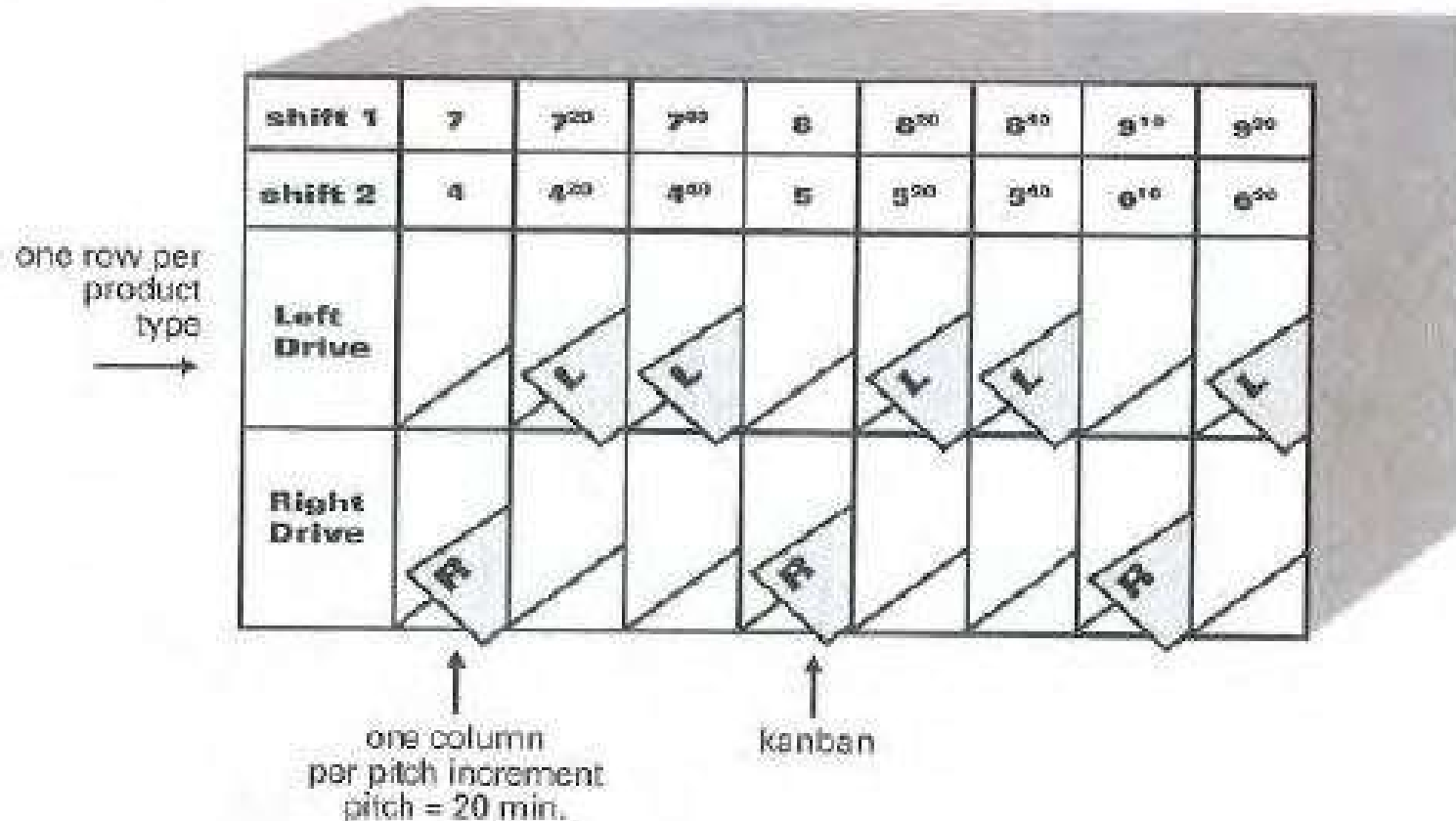
6- Leveling the Production Mix





Future State Map

7-Pitch

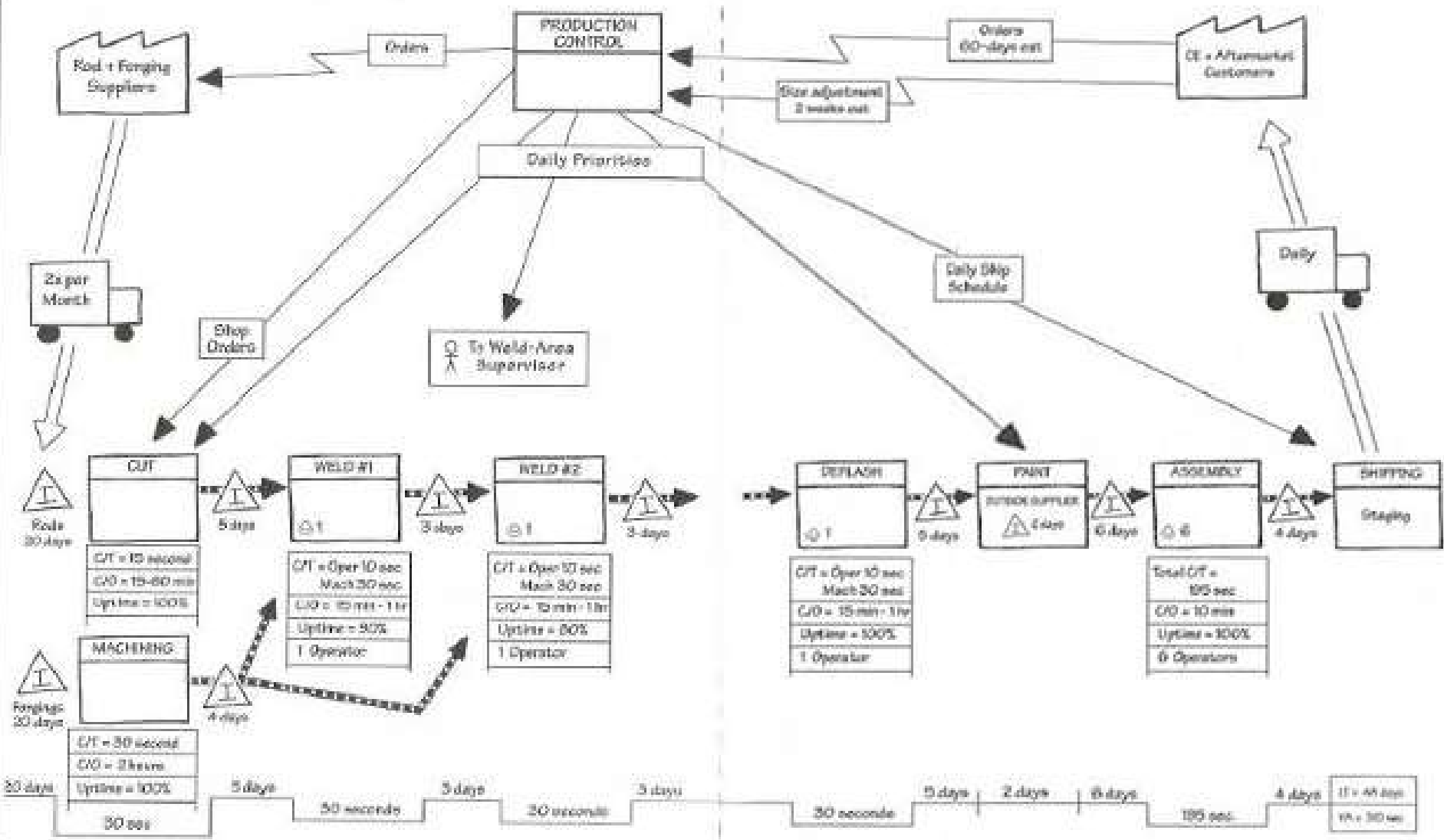




Future State Map

8-Process Improvements

- **Examples:**
 - Reduction Changeover time
 - Total Work content time
 - Uptime





Achieving the Future- State



Achieving the Future-State

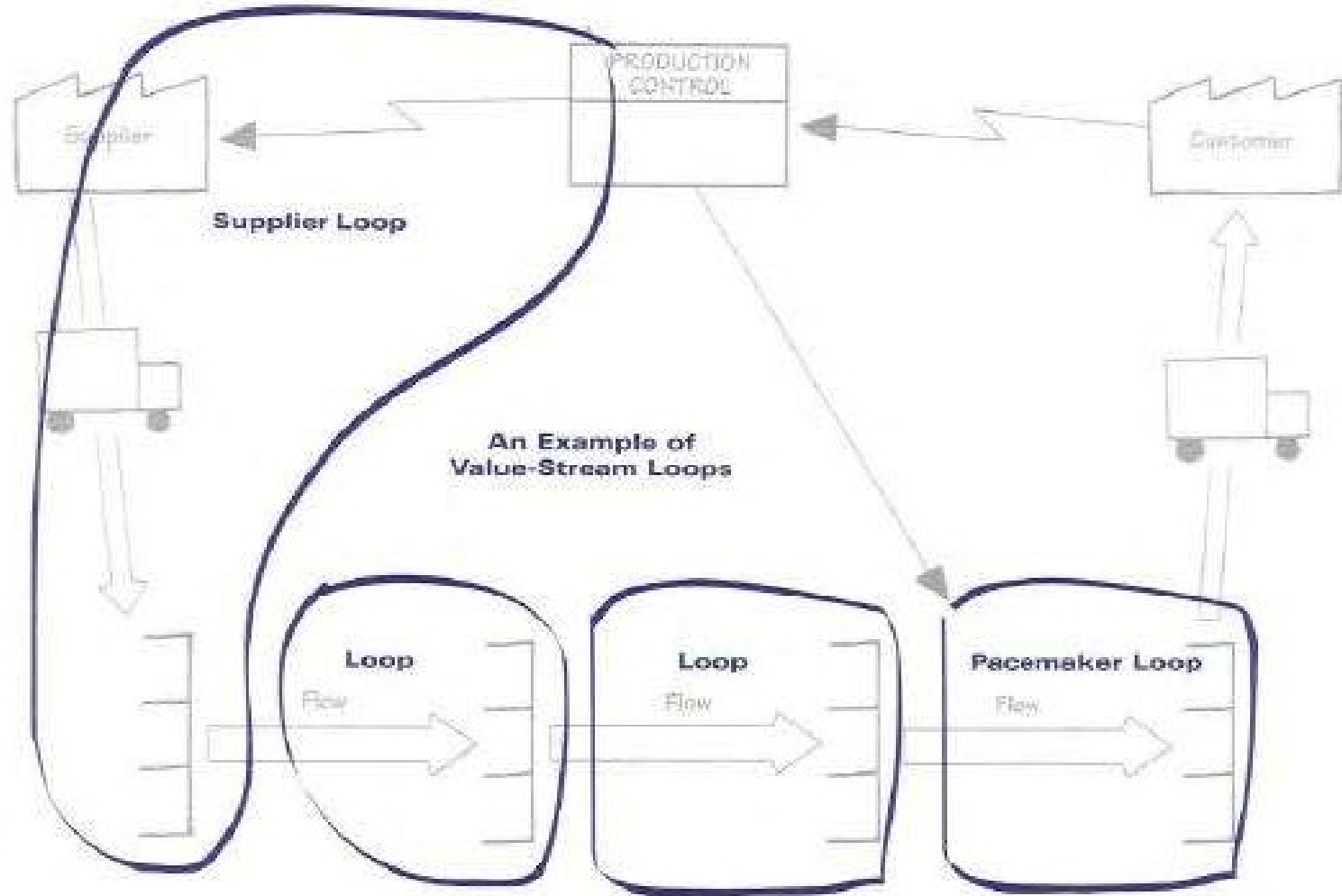
- Breaking Implementation into Steps:

1. Value Stream Loops :

- Objectives
- Goals
- Improvements to a loop often follows this pattern:
 - **Continuous flow** that operates based on takt time.
 - Establish **Pull System** to control production.
 - **Leveling.**
 - Practice **Kaizen.**



Achieving the Future-State Value Stream Loops



Achieving the Future-State

Breaking Implementation into Steps



ISOmantra
Aim • Adapt • Achieve

2. The value Stream Plan

- A yearly VS plan that shows:
 1. What you plan to do step-by-step.
 2. Measurable goals.
 3. Clear check points with real deadline and named reviews.
- Where to begin :
 1. Where the process is well-understood by your people.
 2. Where the likelihood of success is high. (to build momentum)
 3. Where you can predict big bank of the buck.



Signatures

PLANT MANAGER	UNITS	ENGINEERING	MANUFACTURE

YEARLY VALUE-STREAM PLAN

DATE:	JAN 2, 2003
FACILITY MANAGER:	Barb Smith
V.S. MANAGER:	Paul Doe

Product Family Business Objective	V.S. LOOP	Value-Stream Objective	GOAL (measurable)	2003 MONTHLY SCHEDULE												PERFORMING STAGES	RELATED KNOWLEDGE & DEPTS	REVIEW SCHEDULE	
				1	2	3	4	5	6	7	8	9	10	11	12			REVIEWED	DATE
Improve profitability in steering brackets	1 weld	<ul style="list-style-type: none"> * continuous flow from mold-assembly * balon to 100 wpi * eliminate weld c/o * optimize welder #2 * finished goods pull * material handler routes 	2000 wpi 5 100% c/o 4 20% c/o 100% 3 days FG + pull schedule	→	→	→	→												
	2 stamping	<ul style="list-style-type: none"> * stamping pull * stamping changeover 	1 day inventory + pull schedule batch size 300/160 pcs c/o + 10 min					→	→										
	3 copper	<ul style="list-style-type: none"> * pull for coils with daily delivery 	daily delivery & 5-10 days of coils at press								→								



Appendix

Material Icons



Represents

Manufacturing Process

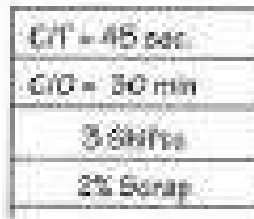
Notes

One process box equals an area of flow. All processes should be labeled. Also used for departments, such as Production Control.



Outside Sources

Used to show customers, suppliers, and outside manufacturing processes.



Data Box

Used to record information concerning a manufacturing process, department, customer, etc.



300 pieces
1 Pk

Inventory

Count and time should be noted.



Appendix



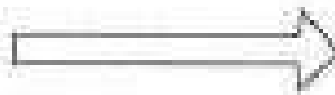
Truck Shipment

Note frequency of shipments.



Movement of production material by **PUSH**

Material that is produced and moved forward before the next process needs it: usually based on a schedule.



Movement of finished goods to the customer







Supermarket

A controlled inventory of parts that is used to schedule production at an upstream process.







Appendix

	Withdrawal	Pull of materials, usually from a supermarket.
	Transfer of controlled quantities of material between processes in a "First-In, First-Out" sequence.	Indicates a device to limit quantity and ensure FIFO flow of material between processes. Maximum quantity should be noted.
Information Icons	Represents	Notes
	Manual Information flow	For example: production schedule or shipping schedule.
	Electronic Information flow	For example: via electronic data interchange.







Appendix

	Information	Describes an information flow.
	Production Kanban (dotted line indicates kanban path)	The "one-per-container" kanban. Card or device that tells a process how many of what can be produced and gives permission to do so.
	Withdrawal Kanban	Card or device that instructs the material handler to get and transfer parts (i.e., from a supermarket to the consuming process).
	Signal Kanban	The "one-per-batch" kanban. Signals when a reorder point is reached and another batch needs to be produced. Used where supplying process must produce in batches because changeovers are required.



Appendix

	Sequenced-Full Ball	Gives instruction to immediately produce a predetermined type and quantity, typically one unit. A pull system for subassembly processes without using a supermarket.
	Kanban Post	Place where kanban are collected and held for conveyance.
	Kanban Arriving in Batches	
	Load Leveling	Tool to intercept batches of kanban and level the volume and mix of them over a period of time.



Appendix



"Go See" Production Scheduling

Adjusting schedules based on checking inventory levels.

General Icons



Represents

"Kaizen Lightning Burst"

Notes

Highlights improvement needs at specific processes that are critical to achieving the value-stream vision. Can be used to plan kaizen workshops.



Buffer or Safety Stock

"Buffer" or "safety stock" must be noted.



Operator

Represents a person viewed from above.